

## **A new *Gordionus* MÜLLER, 1927 from Switzerland (Nematomorpha, Gordiida)**

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**A new *Gordionus* MÜLLER, 1927 from Switzerland (Nematomorpha, Gordiida).** - To date only three species of freshwater Nematomorpha (Gordiida) are known from Switzerland. We report here the finding of two further species, the common species *Gordionus violaceus* (BAIRD, 1853) and a new species, *G. bageli* sp. n., in Switzerland. A diagnostic character for this species is the ring-shaped form of the adhesive warts, structures that are found on the ventral side of males, anterior to the cloacal opening.

**Keywords:** Nematomorpha - Gordiida - new species - Switzerland - *Gordionus*.

## **INTRODUCTION**

About one hundred species of freshwater horsehair worms (Nematomorpha, Gordiida) are known from Europe (Schmidt-Rhaesa, 1997). Diversity and faunistics of horsehair worms in Central Europe are comparatively well known from Germany, Austria, France and Italy (Schmidt-Rhaesa 1997, 2009), but very few records refer to Switzerland. Only three species have been reported: *Gordius villoti* ROSA, 1882 ("Jura", Camerano 1888), *Gordionus alpestris* VILLOT, 1885 ("Jura", Camerano 1888) and *Paragordius tricuspidatus* (DUFOUR, 1828) (Frauenfeld, Kanton Thurgau, Heinze, 1937). We report here records of *Gordionus violaceus* and of one new species, *Gordionus bageli* sp. n.

## **MATERIAL AND METHODS**

Physical characteristics like water temperature (WTW, pH 330), oxygen (WTW, Oxi 340), conductivity (WTW, LF 330), pH-value (WTW, pH 330), water depth (folding rule) and flow rate (MiniAir, Schildknecht) were registered during each sampling (Table 1). The oxygen concentration seems to be very high for sources. This can be explained on one hand by the strong presence of green algae and on the other hand by the fact that measurements have been made in the afternoon only.

TABLE 1: Measurement of water in artificially constructed springs in the forested Röserental, near the city of Liestal, Switzerland.

Species	<i>Gordionus bageli</i> sp. n.		<i>Gordionus violaceus</i> (BAIRD, 1853)		
Sampling date	14 July 2008	1 Dec. 2008	16 May 2008	20 June 2008	27 Oct. 2008
Water temperature [°C]	11.4	10.7	11.7	12.1	10.2
Oxygen [%]	89	105	87	109	100
Conductivity [µS/cm]	526	591	596	482	494
pH-value	7.1	7.1	7.1	7.3	7.4
Water depth [cm]	4.4	4.1	4.9	1.1	0.9
Flow rate [m/s]	0.19	0.15	0.01	0.58	0.01

The reported specimens were fixed in ethanol (70%). Pieces of the cuticle and/or the posterior end were prepared for Scanning Electron Microscopy (SEM). Pieces were dehydrated in an ethanol series of increasing concentration, critical-point dried and coated with gold in a sputter coater. Observation took place using a LEO SEM 1524 at 10 kV. Digital images were taken.

Collecting circumstances: The species here described and discussed have been collected during fieldwork as part of the Ph.D. thesis of the second author. Collections were made in springs of the Röserental, a valley situated near the city of Liestal (Kanton Basel-Land). Geologically, the area forms part of the Jura Plateau which is here expressed as Table Jura. The springs are located in a *Thuja* plantation surrounded by managed forest of mainly native trees at an elevation of 380 m. The forest soil is waterlogged by groundwater and shows tracks of wildlife (wild boar, roe deer) and anthropogenic activities (trampling, forestry work). The main aim of the field work was to study the colonisation of artificially constructed freshwater springs by macro-invertebrates (Gusich *et al.*, in preparation).

RESULTS AND DISCUSSION

*Gordionus bageli* sp. n.

Figs 1-2

HOLOTYPE: One male from the forested Röserental near Liestal (Swiss National Coordinates Lat/Long: CH1903; 619.150/260.325) in the Table Jura. Found in artificial springs constructed near natural springs in a *Thuja* plantation, surrounded by a managed forest of native deciduous trees, 14 July, 2008, leg. V. Gusich. Deposited in the Zoological Museum Hamburg, Germany, accession number ZMH V13278.

PARATYPE: One male, same locality and same sampling details as the holotype, 1 Dec. 2008, leg. V. Gusich. Deposited in the Museum of Natural History in Basel, Switzerland, accession number NMB 2a.

DIAGNOSIS: *G. bageli* sp. n. differs from all other congeneric species by the ring-like shape of the anterior warts on the ventrum in males.

DESCRIPTION: Both males are moderately long and very thin, measuring 110 and 220 mm in length, 0.3 and 0.35 mm in diameter, respectively. The worms are entirely white in colour, a black collar at the anterior end or darker stained ventral and/or dorsal lines are not present.

The posterior end contains structures typical for males of the genus *Gordionus*. The ventral cloacal opening is slightly oval, it is surrounded by short spines which seem to be lacking on the posterior side of the opening (Fig. 1D-E). Anterolateral of

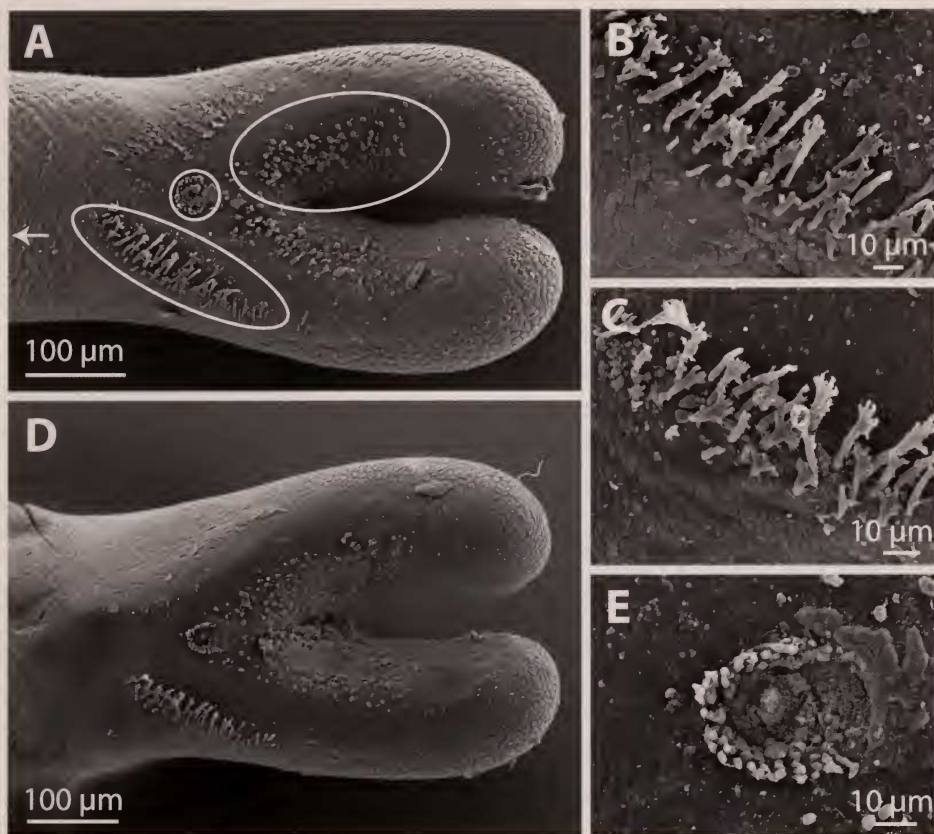


FIG. 1

*Gordionus bageli* sp. n. (A) Ventral view of posterior end of holotype specimen. Circle: position of cloacal opening. Ovals: precloacal row of bristles and postcloacal spines. Arrow: position of adhesive warts anterior of the region shown in the figure. (B-C) Apically branched bristles from the precloacal rows from holotype (B) and paratype (C) specimens. (D) Posterior end of paratype specimen. (E) Magnification of cloacal opening with circumcloacal spines.

the cloacal opening are paired rows of bristles (Fig. 1A-D). These bristles are longest in the center of the row and decrease in size towards both ends. Most bristles are strongly branched apically (Fig. 1B-C). Posterior of the cloacal opening are conical spines, these extend onto the inner side of the tail lobes for about 2/3 of their length (Fig. 1A-D). In the ventral region anterior of the rows of bristles, distinctive adhesive warts are present. They roughly form a ring (resembling a bagel) (Fig. 2A-B). The cuticle contains polygonal areoles that are separated by narrow interareolar grooves (Fig. 2C-D). There are no structures in the interareolar grooves, the material pictured (e.g. Fig. 2C) is contaminated. Quite rarely, the megareolar pattern is found (Fig. 2D). This pattern describes the position of a short tubercle in the centre of the broad side of two neighbouring areoles (Schmidt-Rhaesa, 2002).

**ETYMOLOGY:** The name derives from the circular structure of the adhesive warts, looking like a bagel.



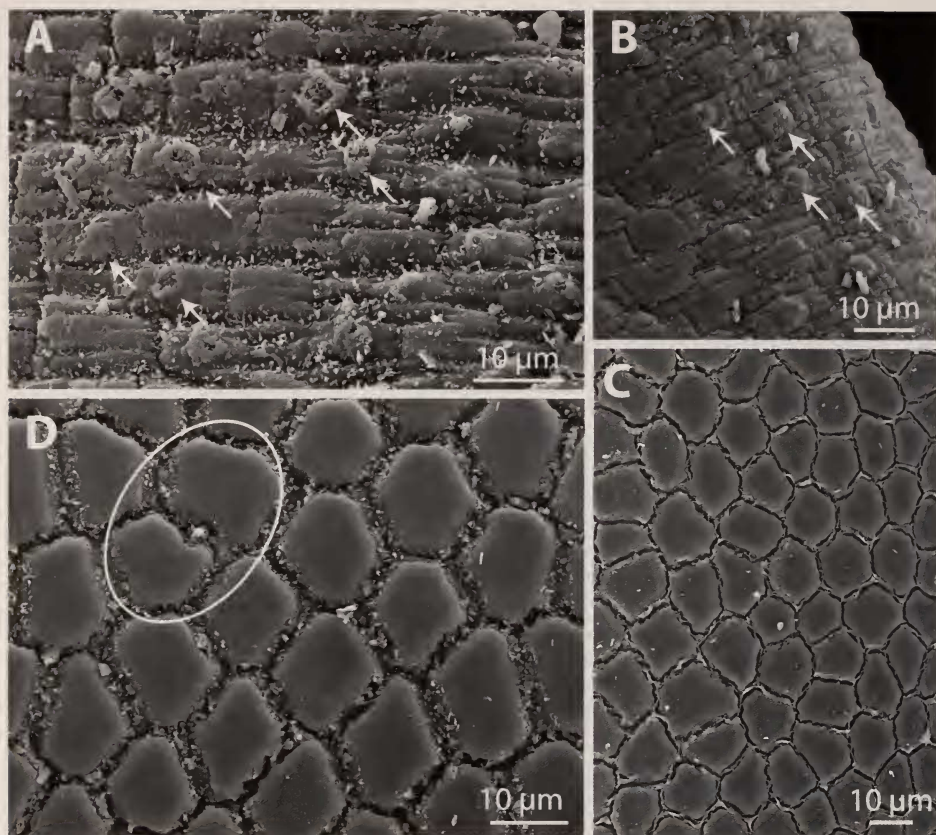


FIG. 2

*Gordionus bageli* sp. n. (A-B) Adhesive warts (arrows) on the ventral cuticle of holotype (A) and paratype (B) specimens. (C-D) Areoles on the cuticle at midbody region. Oval (in D): arrangement of areoles in a megareolar pattern.

DISCUSSION: Anterior warts were first termed “Greifwarzen” by Müller (1926). He also found these structures on the ventral cuticular surface of the posterior end and assumed an adhesive function during copulation. There are no published observations from copulating *Gordionus* species, leaving open the question whether these structures are really involved in copulation. Adhesive warts can have different shapes. Those ones that have been studied by SEM are elongate, parallel to the longitudinal axis of the worm and have a keel (de Villalobos *et al.*, 2001 and Schmidt-Rhaesa, 2001, 2002 for *G. violaceus* (Baird, 1853); Schmidt-Rhaesa *et al.*, 2003 for *G. lineatus* (Leidy, 1851) and *G. sinopilosus* Schmidt-Rhaesa, Hanelt & Reeves, 2003; Schmidt-Rhaesa & Cieslak, 2008 for *G. barbatus* Schmidt-Rhaesa & Cieslak, 2008), others may be more conical (Schuurmans Steekhoven, 1943 for *G. alpestris*) or angled (Müller, 1926, for *G. lunatus* MÜLLER, 1927), but ring-shaped adhesive warts have not been reported and are therefore diagnostic for *G. bageli* sp. n.

The white colour of both male individuals can be interpreted in different ways. During their parasitic phase the worms are white, the cuticle usually turns brown briefly before emergence of the host, probably by some tanning processes in the adult cuticle that has replaced the thin larval cuticle (Schmidt-Rhaesa, 2005). Therefore it can be assumed that white or light specimens collected in the field represent young specimens in which the cuticle is not finally developed. However, there appear also to be species in which the cuticle remains very light in colour throughout life, such as *G. lineatus* (Schmidt-Rhaesa *et al.*, 2003).

Müller (1926) suspected adhesive warts to be diagnostic for the genus *Gordionus*, but they have not been described from a number of species. This may be due to overlooking these structures, but in some cases they appear to be truly absent. Additionally, adhesive warts have been found in one species from a different genus, *Beatogordius abbreviatus* (Villot, 1874) (Schmidt-Rhaesa & Bryant, 2004), making their evaluation as diagnostic for *Gordionus* questionable.

### *Gordionus violaceus* (BAIRD, 1853)

NEW DISTRIBUTION RECORD: Three males were found in Röserental near Liestal. Site and sampling details as for *G. bageli* sp. n. (see above). Sampling dates: 16 May, 20 June and 27 October 2008, leg. V. Gusich.

REMARKS: *Gordionus violaceus* is a species widespread in Europe (Schmidt-Rhaesa, 1997) and also present in North America (Schmidt-Rhaesa *et al.*, 2003). It is likely that this species is highly polymorphic, ranging from specimens showing areoles completely isolated from each other to different grades of fusion of areoles (Schmidt-Rhaesa, 2001), a pattern that was regarded as typical for a separate species, *G. wolterstorffii* (CAMERANO, 1888). The newly reported specimens from Switzerland reflect this diversity in cuticular structure showing either isolated areoles or fused areoles.

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